Algorithmic Trading- Changing The Paradigm of Stock Trading in The Indian Capital Market

Shubhashree Acharya
PhD Research Scholar, CHRIST (Deemed to be University), Bangalore

Dr. Anuradha. P
Assistant Professor, CHRIST (Deemed to be University), Bangalore

ABSTRACT
The advent of technology has conquered most of the facets of human life. This development has affected the way financial markets function.The revolution of Information Technology started from abolishing of open-outcry system to de-materialization and online settlement process has come a long way. Today it is at a point where human intervention is becoming minimal in stock trading. This research paper explores the structure of the present Algorithmic trading in India. Algotrading is the use of computer based algorithms in order to make trading decisions. India welcomed AT only in 2010. Although few economies have reaped the benefits of using Algotrading, the order-book of Indian stock exchages too have seen a surge in AT based orders. This paper aims to find if there has been any significant change in Number of shares traded and turnover pre and post the introduction of Algotrading.

Keywords: Algorithmic Trading, Mode of trading, Quantum of trades, Market turnover

INTRODUCTION

Trade and Commerce has a come a long way from the invention of steam engine to the advent of Information Technology. The world we know of today is a complex anatomy of machines as much as anatomy of human beings. Today most of the things we perform are automated and humans are only instructing and feeding the system with what is known as algorithm. The stock market too has undergone a sea change. The revolution of Information Technology started from abolishing of open-outcry system to de-materialization and online settlement process has come a long way. Today it is at a point where human intervention is becoming minimal in stock trading (Aggarwal, 2014). This change is called Algorithmic Trading; popularly known as Algo Trade.

ALGORITHMIC TRADING

Algorithmic trading is the use of computer based algorithms in order to make trading decisions(Hendershott, 2011) Several authors have tried to define the term AT and all the definitions converge only one common theread which is the use of computer algorithms inorder to place order. The Securities and Exchange Board of India defines AT in its guidelines dated March 30,2012 as an order executed using automated systems. (Discussion paper on Strengthening of the regulatory framework for Algorithmic trading and co-location)

Although Algorithmic trading (hereafter called AT) has emerged post 1990 in few advanced security markets (Hendershott, 2011) the research on this area is nascent. Algorithmic trading in India accounts to 49.8% across the cash and derivatives market and has risen in eight years from merely 9.26% (average) in 2010.(Financial Express, May 8, 2018)

ALGOTRADING IN INDIA

India welcomed Algo Trading in the year 2008 and was formally used as amode of trading since 2011 onwards. The Securities Exchange Board of India (SEBI) permitted AlgoTrading in India in the year 2008 after it allowed a technology known as Direct-Market-Access (DMA). DMA is a technology which allows a trader to use the stock exchange's network by using the interface provided by a broker (Karagozoglu, 2011)

The AlgoTrading is regulated by SEBI and India is one among very few countries which has a stringent mechanism in place inorder to regulate AT based orders. In August 2016 SEBI solicited the opinion of market makers regarding the impact and regulation of AT through discussion paper titled "Discussion paper on 'Strengthening of the Regulatory framework for Algorithmic Trading & Co-location'(SEBI,2016)

The structure of AlgoTrading in India is limited to proprietary traders. These traders are expected to disclose their Algo strategies and get the regulator's permission. Such algorithms which are detrimental to the market liquidity will not be permitted by SEBI. But in April 2018, In order to facilitate small- and medium-sized trading members, SEBI asked stock exchanges to introduce 'managed co-location services', wherein space

will be provided to vendors along with technical knowhow and other expertise (https://www.bloombergquint.com/markets/sebi-strengthens-algo-trading-rules-co-location-facilities#gs.7YRVLLk, 2018)

Fig1: Proportion of orders received from Algo Trading www.bseindia.com

The above graph indicates the percentage of orders received only from Algorithms. The AT as a mode of trading was introduced in BSE only from 2011 onwards. It can be seen that it was in the year 2013 and 2014, orders received from Algorithmic Trading was the highest. Although a precise reason to attribute to this cannot be identified, it can be assumed that in these years the proprietary traders & institutional investors understood and harnessed the advantage of using AT for their gain. Years 2018 comprises of data tabulated from January 2018 to September 2018 only. However in the year 2016 SEBI had drafted several guidelines inorder to regulate AT. This may have been a reason for the fall in the proportion of AT orders.

LITERATURE REVIEW

Although Algorithmic trading or Blackbox trading has been around for more than a decade now, still the literature base is minimal. Most of the literature is in developed stock exchanges like NYSE, research in India is scarce.

This literature review explores various dimensions through which Algo Trading has been studied.

The concept of Algorithmic Trading took birth somewhere during 1980 onwards. Almost all the literature that discusses Algo Trading defines its meaning. Hendershott(2011) is one of the most cited authors in this field and he defines AT as use of computer programmes to execute market orders. He also opines that AT is not just about execution but also "automatically makes trading decisions"(Hendershott, et all2011) Peter Gomber also relates to the same definition but adds a new dimension to the existing meaning. He says Algo trading works in "real time time". Another aspect is that using AT a trader can access multiple markets which others have not broached(Gomber,2014) Almost all the authors highlight the concept of minimal human intervention in AT. The definition as proposed by SEBI in its discussion paper also highlights the same meaning. (SEBI,2016)

Paralelly there is another concept that has become equally popular to AT is called High Frequency Trading or HFT. Several authors treat HFT as being a part of AT and that it is just one of the trading strategy included in AT. The most comprehensive definition of HFT is given by International Organization of Securities Commissions (IOSCO) in its Consultation Report 'Technological Challenges to Effective Market Surveillance Issues and Regulatory Tools'(August,2012)One prominent feature as suggested by several literature is that HFT is about frequent order update and high volume of transactions(Gomber,2014)

Cvitanic and Kirilenko(2010) were the first authors who probed if HFT affected asset prices. They opine that introduction of computers will change the way stock prices move. They have probed the value addition made by the AT to stock market. Harris (2015) also explores the impact of AT not HFT on security market quality.

Several authors conducted impact study of AT , HFT on various dimensions of stock market. Hendershott et al (2011), (Scholtus,2012) , Ji-Yong Seo and Sangmi Chai (2013). Brogaard and Hendershott (2014) jointly

in their paper explore price discovery as a variable. to study the impact of HFT on stock market. Jonathan Brogaard explores the impact of HFT on market quality of US market. He measures market quality through price discovery, volatility and market liquidity. (Brogaard,2014).

Very few Indian researchers have explored the area of AT and its impact on the Indian stock exchange. Nidhi Agarwal and Susan Thomas have been able to capture the LIMIT ORDER BOOK data from NSE. They opine that AT has a good impact on stock market quality and improves market liquidity.(Agarwal,et al.2014) . Sarika and Sreekumar in their research observe the Elliot wave theory in the backdrop of AT (Sarika et al,2013)

OBJECTIVES OF THE STUDY

1. **To ascertain if there is any significant change in quantity of trades before and after Algotrading was introduced in India.**
2. **To ascertain if there is any significant change in terms of amount of** turnover (Rs) before algotrading and after algotrading was introduced.

Hypotheses for the study

The main hypotheses of the study are:

1. H0: There is no significant change in quantum of trades before and after Algotrading was introduced in India.

   H1: There is a significant change in quantum of trades before and after Algotrading was introduced in India.

2. H0: There is no significant change in terms of amount of turnover (Rs) before algotrading and after algotrading was introduced.

H1: There is a significant change in terms of amount of turnover (Rs) before algotrading and after algotrading was introduced.

METHODOLOGY

This paper aims to understand the shift brought about due to Algorithmic trading in India. The data is based on the historical data obtained from BSE (Bombay Stock Exchange). The data culled out from the BSE database comprises of data on quantity of shares traded, amount of turnover(Crores of Rupees) and the data is from 2002-03 to 2019. Monthly data on mode of trading from the year 2011-January 2020 has been considered. Quantity of trade refers to the total number of trades that have taken place in the BSE for a particular year. Amount of turnover refers to the total number of shares traded multiplied by respective price at time T.

An independent sample t test was used inorder to assess if there is any statistical significance between the mean of two groups. The number of years considered is from 2002- 2011 which is referred Before or Pre-Algo period and the years from 2011 till current date is referred as After or Post -Algo period. The number of years in this period also includes data for 2020 January.

SPSS has been used inorder to analyse the data.

RESULTS AND ANALYSIS

Following were the results **:**

Hypotheses 1:

H0: There is no significant change in quantity of trades before algotrading and after algotrading was introduced.

H1: There has been a significant change in quantityof trades before algotrading and after after algotrading was introduced

Total number of trades of an year of 18 years was grouped into 2.; before algo trading group (n=9) comprises of data for a period of 9 years from 2002-2011 and after algo trading group (n=9) comprises of data for a period of 2011- 2020.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Combinenew	Equal variances assumed	5.381	.034	-.461	16	.651	-.04012	.08695	-.22444	.14420
	Equal variances not assumed			-.461	12.750	.652	-.04012	.08695	-.22834	.14810

The mean number of trades before Algotrading was compared with the mean number of trades after algotrading. The Normality test reveals that the number of trades was normally distributed for both the groups and homogeneity of variance was tested using Levene's Test. An independent -t test was conducted to find out if the difference in the means was statistically significant. It was found that there is no significant difference between the mean of trades before algotrading(M=8.5285) and mean of trades after algotrading(M=8.5686),t(18)=-0.461), p=0.652, with a difference of -0.04012, 95% CI.

Thus we will fail to reject our Null Hypothesis and can ascertain that there is no significant change in the quantity of trades after the introduction of Algotrading.

Hypothesis 2

H0: There is no significant change in Turnover (Rs) before algotrading and after algotrading was introduced.

H1: There has been a significant change amount of turnover(Rs) before algotrading and after algotrading was introduced

Total number of trades of an year of 18 years was grouped into 2.; before algo trading group (n=9) comprises of data for a period of 9 years from 2002-2011 and after algo trading group (n=9) comprises of data for a period of 2011- 2020.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Turnover	Equal variances assumed	4.428	.052	1.180	16	.255	184927.78222	156784.15510	-147439.77900	517295.34345
	Equal variances not assumed			1.180	11.649	.262	184927.78222	156784.15510	-157820.18226	527675.74671

The mean turnover before Algotrading was compared with the mean turnover after algotrading. The Normality test reveals that the turnover was normally distributed for both the groups and homogeneity of variance was tested using Levene's Test. An independent -t test was conducted to find out if the difference in the means was statistically significant. It was found that there is no significant difference between the mean of turnover before algotrading(M=918938.4844) and mean turnover after algotrading(M=734010.7022),t(18)=-0.1.180), p=0.262, with a difference of 156784.15510, 95% CI.

Thus we fail to reject our Null Hypothesis and can ascertain that there is no significant change in the amount of turnover after the introduction of Algotrading.

CONCLUSION

Although Algotrading is not a new concept in India, it is yet to receive full acceptance by all players in the Stock market. Although several research claim the benefits of Algotrading, from the above study it is yet to be determined if Algotrading has contributed in terms of increasing quantity of trade and amount of turnover. It has been only 9 years from the inception of Algotrading in India and therefore only that period could be used for analysis which may not be robust enough to measure Algotrade's significance. Also since there are other modes of trading apart from Algotrading, there is further room for research. However it can be said that Algotrading has certainly brought a paradigm shift in the Indian Capital market but its ramifications on other aspects of trading is yet to be ascertained.